

The Specter of Sprawl



Urban sprawl is endemic throughout the United States, and there is widespread concern over its potential environmental and public health impacts. Many of the nation's cities are consuming land faster than their populations are growing, pushing the specter of urban and suburban pollution farther into rural corridors. Chicago and Los Angeles, for example, have over the last 20 years increased their land area more than 10 times faster than their populations. In a particularly striking example of sprawl, Phoenix, Arizona, is encroaching upon the desert at a rate of one acre per hour, leading Michael Fifield, head of the architecture department at the University of Oregon in Eugene, to comment that "the only thing stopping Phoenix is Tucson."

Unchecked urban growth is linked to many environmental problems, including increased automobile emissions, deterioration of air and water quality, loss of rural lands, and a declining sense of community. The emerging consensus among citizens, planners, government officials, and environmental groups is that sprawl is unsustainable, and coordinated land use planning strategies are needed to check its growth.

What is Sprawl?

Because there is no clear-cut distinction between sprawl and suburbanization, simple definitions for sprawl are hard to come by. Reid Ewing, an associate professor in the College of Engineering and Design at Florida International University in Miami, says that "like obscenity, you may not know exactly how to describe [sprawl], but you know it when you see it. It's a matter of degree. It's hard to say exactly where sprawl begins and ends." Reid has nonetheless come up with a widely referenced definition for sprawl, which he describes as random development characterized by poor accessibility of related land uses such as housing, jobs, and services like schools and hospitals. Among these undesirable land use patterns he includes commercial strip development, low-density residential developments, and scattered, isolated developments that leapfrog over the landscape.

According to Ewing, one thing all of these land use patterns have in common (in addition to automobile dependency) is a lack of open, functional space. For some people, this sense of isolation from the natural environment is a health threat in and of itself. In one study, published in the

November 1991 issue of the *Journal of Environmental Psychology*, Roger Ulrich, a professor of architecture and urban planning at Texas A&M University in College Station, linked the visual clutter of sprawl developments to a variety of stress-related effects, such as elevated blood pressure and increased muscle tension. Based on the results of his research, Ulrich questioned whether "roadside blight and strip 'sprawls' may be in some respects a public health issue, because they are the stuff of experience for tens of millions of people."

Causes of Sprawl

The historical basis for sprawl may well lie in the decentralization of employment. The host of government policies that have subsidized development, built new roads and highways at the expense of public transit, and paid for the "external" costs of the automobile (such as pollution and commuter parking) have allowed suburban employment centers to gain footholds outside of cities, and to draw large numbers of middle-class workers from the urban core. According to Harriet Tregoning, director the Urban and Economic Development Division at the EPA, community officials

sometimes contribute to the problem by giving tax breaks and other incentives to industrial employers looking to develop in suburban areas.

The expanding number of suburban jobs has enabled greater numbers of middle-class workers to leave the city and build homes on the outskirts of town. This phenomenon has caused a number of planners to suggest that sprawl is the United States' development pattern of choice, a logical fulfillment of the "American dream" of a house in the suburbs, a lawn, and a two-car garage. Richard Morrill, a professor of geography and environmental studies at the University of Washington in Seattle, writes in his book *Our Changing Cities* that as many as 80% of surveyed U.S. citizens indicate that they would prefer to live in low-density, single-family housing, if given the choice.

Unfortunately, the flight to the suburbs has often left a crumbling and disinvested urban environment in its wake. The effect is sometimes circular—as residents leave the city, the economy of the urban environment declines, causing more people to leave. In some areas, for example Kansas City, Missouri, where the urban edge is moving beyond downtown at a rate of 2 miles per decade, the result is a "golden ring" of expensive houses that surrounds the city, but within which lies a landscape of boarded-up shopping centers, vacant lots, and unsold properties.

But because the short-term economic benefits brought on by the flow of construction dollars accrue immediately, planning officials are often tempted to overlook the imminent downside of inadequately planned development. Developers, banks, and municipal officials are often all too pleased to accommodate new homeowners as they open their checkbooks and stimulate local outlying economies. The problems come later, once the boon from construction is over, and residents begin to demand services such as roads, schools, sewer lines, and emergency services in excess of what the primarily residential tax base can afford. The inevitable result is higher taxes. The alternative to higher taxes is sometimes a reduction in the number—or quality—of the services provided, a potentially perilous state of affairs. The American Farmland Trust (AFT), a Washington, DC-based nonprofit organization, recently disclosed in their 1998 report *Living on the Edge: The Costs and Risks of Scatter Development* that response times for police, ambulance, and fire departments to outlying houses and subdivisions often exceed national standards, potentially putting residents that

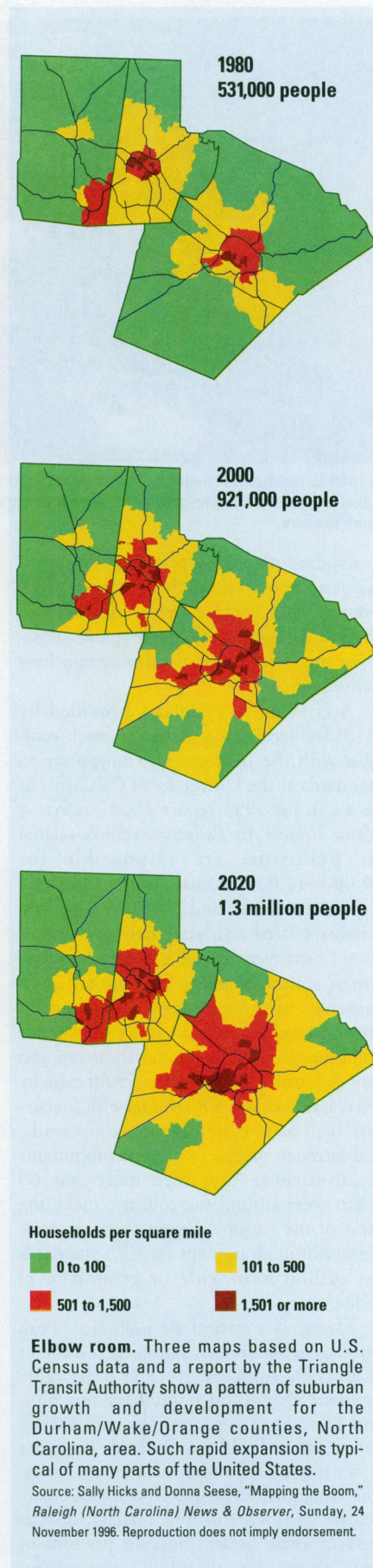
live in these areas at increased risk to their health and safety.

Government subsidies also finance consumer use of the automobile, without which low-density developments could never exist. The former White House Office of Technology Assistance (OTA), in its 1995 report *The Technological Reshaping of Metropolitan America*, found that automobile drivers only pay around 73–88% of the monetary costs of auto use. If nonmonetary costs such as air pollution are included, then the cost paid by users decreases to a range of 53–69%. The OTA report goes on to add that a 1991 study conducted by the World Resources Institute estimated that if the hidden costs of air pollution, congestion, and parking were internalized and paid for by drivers themselves, the price of gasoline would rise to approximately \$7 per gallon. As it is, the cost of gasoline in the United States, when adjusted for inflation, has actually decreased since the early 1970s, and U.S. consumers pay as little as one-fourth of what consumers pay in most other countries.

Finally, government subsidies have paid for the new roads, highways, and bridges that make sprawl possible. Don Chen, research manager at the Surface Transportation Policy Project, a Washington, DC, nonprofit organization, comments that estimated on a per-capita basis, urban and densely populated suburban areas receive roughly half as much government financing for road construction and maintenance as rural areas. What surprised Chen was that these findings came in spite of the stated goals of the Intermodal Surface Transportation Efficiency Act of 1991, which called for increased spending on maintenance of existing road systems and less funding for new systems.

Urban Sprawl and the Automobile

The keystone to the suburbs is the automobile, and with urban sprawl has come a dramatic rise in automobile use. According to the latest figures published in the Federal Highway Administration report *Highway Statistics*, total vehicle miles of travel (VMT) in the United States increased by 59% from 1980 to 1995. Most of this increase is attributed to increasing trip and commuter distances, reflecting an increasing segregation between jobs and housing. This is a particularly vexing problem because many primary air pollutants are increasingly linked to vehicle emissions rather than stationary industrial sources. "We're at a point now where the opportunity to further limit emissions from large stationary sources is small," says Tregoning. "Small discrete sources like cars, which are less amenable





A road to nowhere. A major source of adverse environmental and health effects of urban sprawl is air pollution caused by ever-growing numbers of cars being driven greater numbers of miles to and from work in cities.

to standard regulatory practices, are now a major source of air pollution with VMT continuing to increase very steadily. It's an enormous threat to air quality, and something that EPA is not entirely certain how to deal with."

According to estimates provided by Mark Delucchi, an associate research ecologist with the Institute of Transportation Standards at the University of California at Davis, in his 1995 report *Health Effects of Motor Vehicle Air Pollution*, vehicle-related air pollutants are responsible for 20,000–40,000 annual cases of chronic respiratory illness, and 50–70 million respiratory-related restricted activity days per year. In many areas, vehicles are the single largest source of many air pollutants. In particular, vehicles are the major source of ground-level ozone, the most serious air pollution problem in the northeastern and mid-Atlantic states. Ozone is formed by the reaction of oxygen radicals with precursors such as volatile organic compounds, and nitrogen oxides, common components of car exhaust. Altogether, more than 60 urban areas around the country, including most of the nation's largest cities, are currently not in attainment for EPA standards for carbon monoxide or ground-level ozone.

Ozone is a critical air pollutant. Peak ambient ozone concentrations in a number of areas are sufficient to elicit measurable transient changes in pulmonary function, and can cause a variety of respiratory symptoms in healthy individuals engaging in normal exercise and outdoor activities. The situation for people who may be particularly sensitive to ozone toxicity, such as children (who breathe more air per unit of body weight than do adults), the elderly,

and asthmatics is even worse.

A number of researchers, including Peter Gordon, a professor of planning and economics in the department of economics at the University of Southern California in Los Angeles, are not convinced that increasing VMT is contributing directly to poor air quality. Their arguments hinge on a number of factors. For example, while sprawl does result in increased VMT, much of the mileage accrues on highways—and vehicular pollution decreases with increasing speed (up to about 45 miles per hour).

Furthermore, urban airsheds are limited relative to the density of their populations, and are thus less able to absorb pollutants than airsheds in lower-density suburban environments. If viewed from the perspective of exposure, many more people are affected by poor air quality in the cities than in the suburbs.

Finally, an estimated 50% of all vehicle-related pollutants are released during two critical periods: upon ignition (cold starts) and during the so-called hot-soak period that occurs as the car cools down. The more relevant relationship may be not so much between air quality and increased VMT, but rather between air quality and the number of individual vehicle trips. The effect of more vehicle trips is a subject of continuing study.

Even with the increase in VMT, the EPA Office of Air Quality Planning and Standards' report *National Air Pollutant Emission Trends, 1900–1995* states that overall the United States' air quality continues to improve. Says Gordon, a vocal critic of the anti-sprawl movement, "The data are clear about what we have: better, though far from perfect, air. The projec-

tions are the usual doomsday forecasts. Internal combustion engines are ever better and cleaner. This explains the paradox of better air but more VMT."

The EPA is holding its ground, however. Citing data gathered by the same EPA trends report from the previous year, Tregoning makes the point that, although it is true that the country appears to be enjoying improved air quality, pollutants given off by increased VMT will eventually reverse this trend by the year 2005. "This is in spite of advances in engine design, and the use of reformulated fuel," she says.

Ironically, the use of catalytic converters to reduce vehicle emissions is inadvertently increasing emissions of nitrous oxide (N_2O). This is because catalytic converters get so hot during their normal use that they facilitate the oxidation of nitrogen in the air. According to the draft EPA report *1998 Inventory of U.S. Greenhouse Gas Emissions and Sinks (1990–1996)*, N_2O emissions increased 44% from 1990 to 1996, primarily due to the rates of emission in new vehicles. These emissions impact directly on public health. Like other nitrogen oxides, N_2O molecules react with volatile organic compounds in the atmosphere to form smog, which can cause breathing difficulty for asthmatics, coughs in children, and general respiratory illnesses. Additionally, like a number of other vehicle-related pollutants, especially carbon dioxide (CO_2), N_2O plays a major role in the greenhouse effect. Although its emissions are much lower than those of CO_2 , N_2O is approximately 310 times as powerful when it comes to trapping heat in the earth's atmosphere.

According to the same EPA report, all greenhouse gas emissions have been increasing in the United States over the last decade. Much of the increases are due to rising VMT, although emissions from stationary sources, particularly power utilities, are also important. There is now a near-consensus in the scientific community that greenhouse gas emissions are causing global climate change, with potentially catastrophic consequences. The United States is the world's largest producer of CO_2 , and transportation is gradually assuming an increasing share of the total output.

In an innovative twist on regulatory policy, Tregoning and her colleagues, in cooperation with the EPA's Office of Air and Radiation, are exploring ways to use the agency's authority under the Clean Air Act (CAA) to allow metropolitan areas to count urban policies that reduce emissions towards the state's attainment of clean air standards. Their goal is to reward local

urban zoning policies that reduce vehicle travel while encouraging and enhancing urban redevelopment. Proposed measures include zoning that encourages greater density around existing mass transit facilities, incentives to increase mass transit ridership, and elimination of zoning requirements that, among other things, prevent mixed use neighborhoods in urban areas. "These proposals have been well-received," says Tregoning. "We want to make this a real option for a state developing a State Implementation Plan under the CAA. It's a pilot project, but it's very promising."

Decreased air quality is only one potential health threat from increased automobile use, however. According to the 1997 report *Mean Streets: Pedestrian Safety and Reform of the Nation's Transportation Law*, issued by the Surface Transportation Policy Project, over half of the United States' 6,000 annual pedestrian fatalities occur on neighborhood streets. The report issued a finding that the most dangerous metropolitan areas are the "newer sprawling southern [and] western communities, where transportation systems are biased toward the car at the expense of other transportation options."

Impacts to Rural Areas

Among sprawl's more paradoxical features is that its greatest impacts are on the extremes of the land use continuum. As sprawl drains jobs, people, and infrastructure out of the urban center, it is moving them into the small towns and farms of the rural United States. The AFT has been watching this demographic change closely, and states in its report that the United States' best farmland is being lost at an ever more rapid pace. "The best farmland is flat, well-drained, has few trees, basically exactly what the developers ordered," says Ann Sorensen, director of the AFT's



Standing water. Large areas of paved surfaces in suburban developments mean less water is absorbed, resulting in flooding and toxic runoff entering rural water sources.



Center for Agriculture and Environment. Using the most recent data compiled by the U.S. Department of Agriculture's Natural Resource Inventory, the AFT estimates that nearly 50 acres of prime farmland in the United States are being lost every hour of every day, primarily due to "scattered and fragmented urban development near major metropolitan areas."

The environmental consequences of farmland loss are complicated and frequently debated. There seems to be a general consensus among land use experts that the United States has more than enough land to provide food for both domestic consumption and export. Gordon, for example, suggests that the country has a surplus of agricultural produce and arable farmland, and that even a doubling of urban land uses wouldn't seriously affect agricultural output. However, according to Sorensen, the problem is not so much the amount of farmland left behind as sprawl

continues to encroach on rural areas, but its quality. "What we're losing is the best farmland we have," she says. "It's irreplaceable." In his paper *Alternative Views of Sprawl: Is Los Angeles Style Sprawl Desirable?*, published in the Winter 1997 issue of the *Journal of the American Planning Association*, Ewing also counters that declining fisheries, unfulfilled hopes for increased crop yields from biotechnology, and aquifer depletion in certain regions may place additional pressure on agricultural lands, leading to grain shortages by the year 2030.

Sprawl has also been linked to deteriorating water quality in previously rural areas. This is not to say that rural uses—particularly farming—are entirely benign. An EPA report entitled *National Water Quality Inventory—1992 Report to Congress* confirmed that agriculture is the largest source of nutrient pollution to rivers and lakes, and the third most important source for estuaries. Even so, urban runoff still constitutes a major source of pollutants to surface water bodies. The 1994 version of the same EPA report indicated that 12–50% of all surface water pollution originates with urban runoff. Additionally, whereas agricultural runoff tends to be limited to nutrients, runoff from roads and parking lots contains a wide variety of additional pollutants including oils, road salts, nutrients, and sediments, as well as hazardous and solid wastes.

The extent to which urban sprawl contributes to surface water degradation is frequently analyzed in terms of the percentage of impervious (i.e., paved) surface in the watershed. When more than 10% of the



Ground giving way. New uses of land in sprawl developments can mean the loss of productive farmland and soil erosion due to fewer trees.

surface is impervious, most watersheds show signs of degradation. At rates of 25% and above, watersheds are seriously degraded and unable to provide adequate habitat for sensitive species. Interestingly, low-density sprawl developments actually contribute more urban runoff per unit area than do urban environments. Thomas Schueller, a researcher with the Center for Watershed Protection in Silver Spring, Maryland, indicates in his 1995 report *Site Planning for Urban Stream Protection* that sprawl development, with its wide streets and large parking lots, can lead to storm runoff at a rate over 50% higher than the more compact development found in cities.

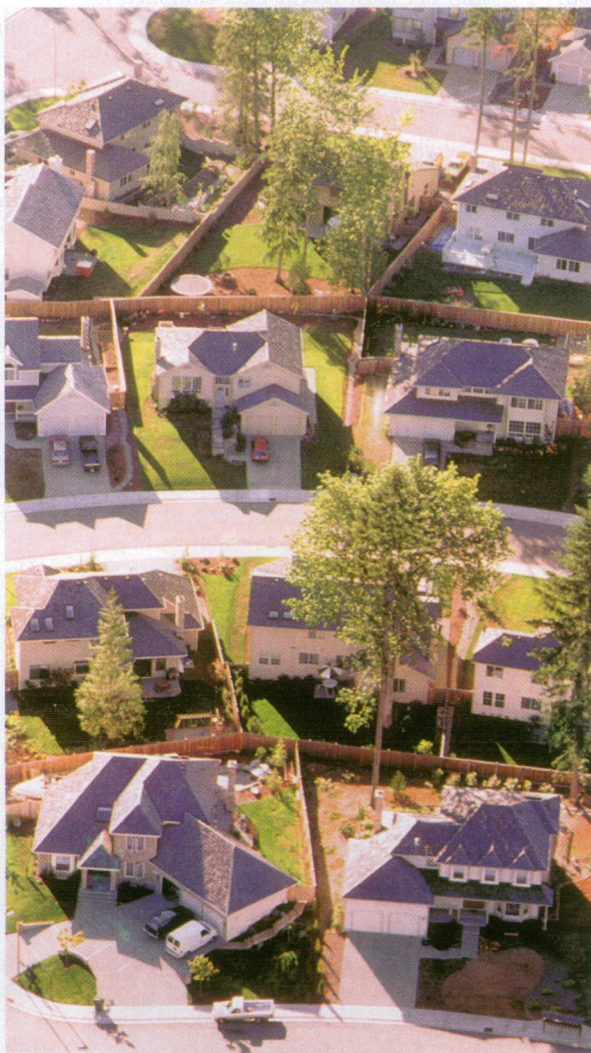
This analysis was experimentally validated in a study conducted by the South Carolina Department of Health and Environmental Control, which compared the extent of urban runoff in a hypothetical "traditional" town configuration, which blended residential and commercial uses, with a typical sprawl configuration. Both were matched for numbers of buildings and potential residents. The researchers found that urban runoff associated with sprawl development was 43% higher than that of the compact development. Their results were presented in the Fall 1997 issue of the *South Carolina Conservation League Land Development Bulletin*.

Additionally, because the reduction in porous surfaces affects natural drainage systems such as streams, wetlands, and other receiving bodies, road construction can go hand-in-hand with increased flooding and erosion. The Sierra Club recently issued a report entitled *Floods, Deaths, and Wetlands Destruction* in which they cite dramatically increased flood deaths from 1993 to 1997, which they link to increasing wetlands loss caused by sprawl.

Sprawl can also have an opposite effect: in some areas, road surfaces prevent the filtration of rainfall through soils that can recharge groundwater supplies. This leads to a lowering of the water table and other impacts on groundwater supplies. These effects are sometimes exacerbated by patterns of residential water consumption. For example, single-family detached homes use large quantities of water to sustain their lawns and gardens. According to a 1989 report released by the EPA entitled *Natural Resources for the 21st Century: An Evaluation of the Effects of Land Use on Environmental*

Quality, new urban growth in a number of states was depleting water supplies at the same time that their populations were increasing, often at the expense of local farming operations.

Effects on the physical environment are only part of the consequence of increased development in rural areas, however. The character of many of the United States' rural towns is also being strained as parcels of land are subdivided and sold off for residential development. A number of the small towns in southern Maine, for example, have seen their populations increase by as much as 18% in the last three years, while growth in the urban centers has leveled off. This rate of growth is resulting in increased taxes and strained social services, and has antagonized the preexisting local population. Many in the local communities look with trepidation at increasing newcomers, fearful of a loss of community and increased suburban crime.



A place of our own. The trend toward spread-out single-family homes can actually lead to a sense of isolation and loss of the community that is found in small towns and urban areas.

Solutions

If there is one thing that most stakeholders working on the sprawl issue seem to agree on, it is that sprawl is essentially a local affair. Just how a community goes about dealing with its growth depends largely on its own environment, culture, and economy. Therefore, government agencies and private organizations working on the sprawl issue are heavily vested in addressing local concerns, even as they recognize sprawl's larger implications.

"Traditionally, land use decisions are made at the local level. We believe that should continue to be the case," says Keith Laughlin, head of the Council on Environmental Quality's (CEQ) interagency task force on urban sprawl. "The question is, how can we assist those at the local level that want help?" he says. "The government has information and technical tools that can assist communities to make the right decisions." At the request of Vice

President Al Gore, the CEQ's interagency task force is currently holding a series of meetings with local land use officials, and drafting a set of recommendations on managing sprawl.

One group that is steadily gaining visibility is the Smart Growth Network, a growing coalition of stakeholders currently comprising 100 individual members and 15 partner organizations including the EPA, the National Resource Defense Council, and the Urban Land Institute (ULI), a Washington, DC-based nonprofit organization that focuses on the concerns of the private sector. The ULI has made smart growth the centerpiece of its policy agenda for the next two years.

The Smart Growth Network has been holding a series of conferences around the United States in an attempt to bring together stakeholders to build local and national land use coalitions to find progressive ways to deal with growth. Network members benefit by having access to the combined resources and expertise of the entire organization. This is useful as they attempt to apply the principles of smart growth to their own communities.

"Smart growth encourages more mixed-use and compact development," says Tregoning. "You can't rely solely on residences to make up the tax base because residential development typically doesn't pay for itself. We're also trying to

encourage investments in the inner cities. We don't imagine we can stop sprawl, but we think we can encourage better development and more livable communities." Smart growth also encourages "infill," a term used to essentially describe focusing investment in existing urban centers and older suburbs rather than in the outlying areas. Federal brownfields projects, which aim to clean up and reopen abandoned or otherwise inactive industrial facilities in the inner cities, are also a high priority.

Maryland is a state that has begun to invest heavily in smart growth. Maryland, which was the Smart Growth Network's first partner-state organization, has historically had tremendous problems with sprawl. Recent estimates by the state's office of planning predict that central Maryland is on its way to consuming as much land in the next 23 years as it has since the state was established. Michael Pawlukiewicz, director of environment and land use policy at the ULI, says, "Around 20% of Maryland is turf: lawns, highway median strips, and golf courses that don't grow food or support wildlife."

But now, under the state's Initiative on Neighborhood Conservation and Smart Growth, launched by Governor Parris Glendening in 1997, citizens, developers, and local officials are carefully planning for the future, and forecasting where growth ought to occur over the next several decades. Once the projected boundaries for these areas are delineated by local government, the legislature limits funding for infrastructure to those areas only. This doesn't mean that homeowners can't build beyond the boundaries if they want to. They can—but they do so with the understanding that the state government isn't prepared to supply them with a sewer line or a school. The smart growth program in Maryland has also established a rural legacy initiative that will protect targeted rural greenbelts from sprawl through the purchase of easements and development rights in areas rich in agriculture, forestry, and natural and cultural resources. Under the smart growth program, buffer incentives will be offered to landowners, who will be provided with grant payments of \$300 per acre to plant forest buffers along streams and watersheds to help minimize nonpoint pollution to the Chesapeake Bay.

To some extent, the concept of smart growth borrows from an existing urban planning model known as the urban growth boundary. Urban growth boundaries were used successfully to limit sprawl and encourage mixed-use development in Oregon, a state often held up by land use planners as a model for growth manage-

ment. Oregon drew urban growth boundaries around all of its major cities in the early 1970s, and prohibited residential development and public transit beyond those lines.

The city of Portland, Oregon, has also undertaken a number of additional progressive land planning initiatives to limit sprawl. These include large investments in mass transit, a focus on locating development adjacent to mass transit systems, a mix of inner city residential and business uses at the pedestrian level, and a limit on downtown commuter parking. These policies have enabled the city to manage its growth effectively while maintaining a high quality of life for its increasing population. More than 50% of the downtown working population (which has doubled since 1975) commutes via mass transit. The mass transit system is so popular among urban and suburban residents that there is very little support for new road construction, and no additional road capacity has been added to the downtown area in 20 years. The city has even removed a six-lane expressway to create room for a downtown riverfront park. According to a report entitled *Why Smart Growth?* by the International City-County Management Association, a Washington, DC-based nonprofit organization, these policies have also led to a dramatic improvement in air quality. CAA violations in Portland have dropped from an average of 100 per year in the 1970s to none since 1987.

Says William Schroer, a project manager with Apogee Research in St. Paul, Minnesota, "Portland has held per-capita VMT steady over the past three years, an impressive accomplishment in an economy that is growing at twice the national average. Among other things, it means that in Portland, increases in driving are not currently eating into the decreased emissions benefits that technology has brought."

Oregon's urban growth boundaries were applied statewide. But more limited uses have also been successful. In Boulder, Colorado, a citywide urban growth boundary called a "service area" has successfully contained sprawl since it was implemented in 1970, and revised in 1978. According to Peter Pollock, director of the community



A shared sense of purpose. Planners say that the use of mass transit will be a key component of stanching the adverse effects of sprawl.

planning division for the City of Boulder, the service area has protected Boulder from development that would have placed infrastructure demands on the city without supplying the necessary tax base to pay for them. In his article *Controlling Sprawl in Boulder: Benefits and Pitfalls*, published in the January 1988 issue of the *Newsletter of the Lincoln Institute of Land Policy*, Pollock comments that the service area policy has led to a number of distinct benefits for the city. For example, the boundary has created an identifiable urban/rural edge that has limited leapfrog development into the surrounding countryside. Additionally, says Pollock, "[Boulder] developed an urban form that was conducive to urban transit, which is probably the toughest nut to crack from the perspective of getting people to adjust to more compact development."

Managing urban sprawl may constitute one the biggest environmental policy challenges facing the United States today. Sprawl is often the core issue behind many of our most highly visible environmental problems. But containing development and implementing coordinated land use programs that restrict how and where people can live is a delicate proposition, fraught with myriad social and perceived political consequences. Nonetheless, land use initiatives such as those implemented in Oregon and Boulder suggest that limiting sprawl while enhancing a sense of community and the quality of life for residential populations is possible. The extent to which sprawl can be contained in other areas will ultimately depend upon how these interrelated interests are balanced on a local level.

Charles W. Schmidt